



Lophophytum weddellii Hook. f. (Balanophoraceae): first records for the Brazilian flora

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Abstract: *Lophophytum weddellii* was known to only occur in unflooded forests between 500–1,000 m in Colombia and Peru. These new records for the Brazilian flora expand the geographic distribution of the species, and also show that it occurs near seasonally flooded forests at lower elevations (<500 m). This work presents taxonomic remarks, photographs of living and herbarium specimens of *L. weddellii*, as well as a geographic distribution map and risk assessment at the regional scale.

Key words: Acre, Brazilian Amazon, holoparasites, parasitic plants, phytogeography

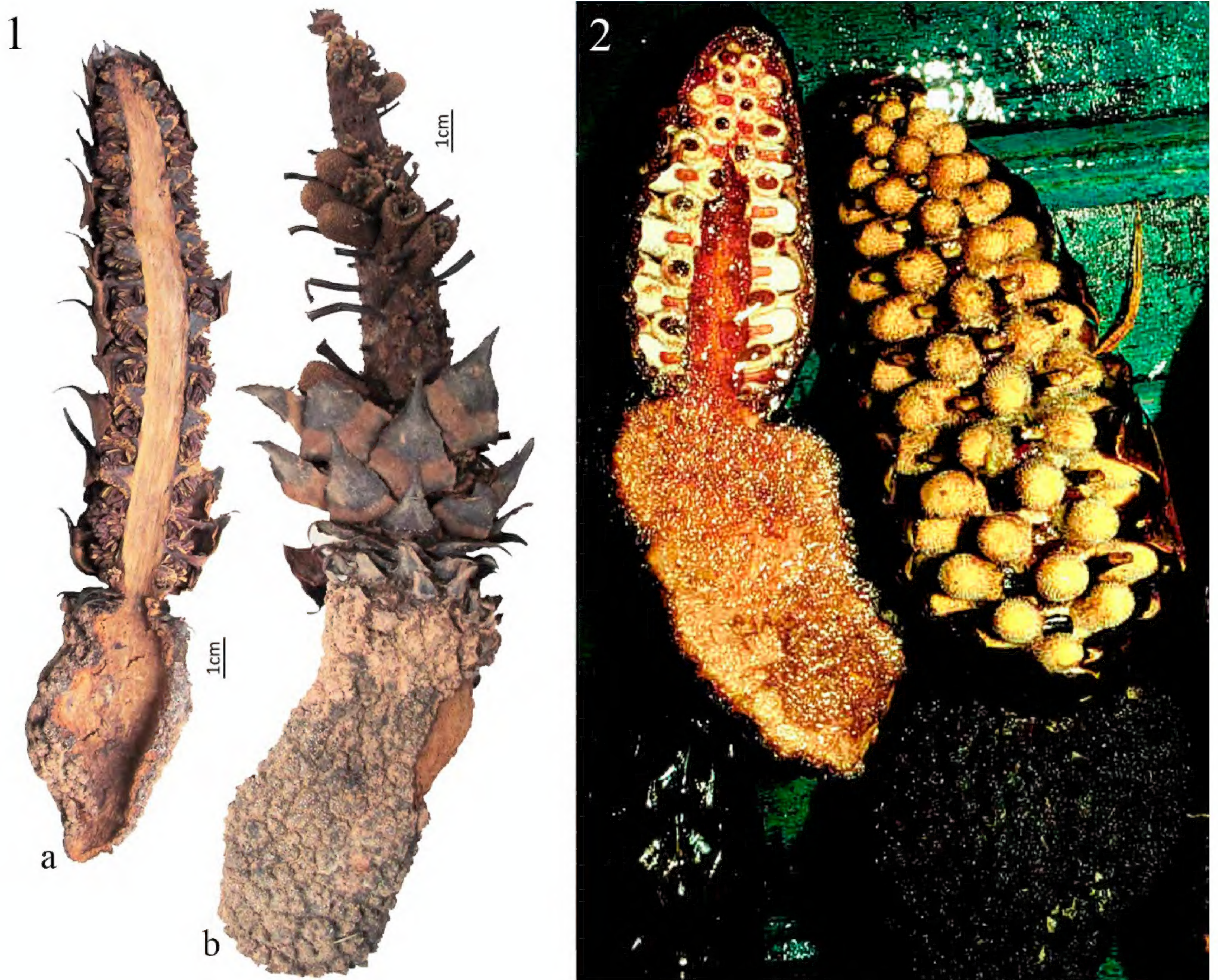
Balanophoraceae is among the most representative holoparasite families of the Neotropics (Heide-Jørgensen 2008). Nevertheless, the actual number of species and mainly its geographic distribution remain poorly known in this region. In the last decade, four new species were described (Delprete 2004; Cardoso et al. 2011; Delprete 2014; Cardoso and Braga in press), whereas several others had their geographic distribution significantly extended (Delprete 2004; MacVean and Knapp 2005; Fontana and Popoff 2006; Cardoso 2014a).

Lophophytum Schott & Endl. (subfam. Lophophytoideae) is a genus with occurrence restricted to South America, which ranges from Colombia to Argentina and comprises four species and one subspecies (Hansen 1980; Kuijt and Hansen 2015). These species are morphologically characterized by the tuber surface covered by irregular lignified slabs, and by the presence of sparse, deltoid, rigid scales. Each tuber usually yields one to five inflorescences that may reach 50 cm in length. The axis of the inflorescence is branched and strobiliform, with deciduous or persistent scale-like bracts that protect each of the branches. In contrast to *Lathrophytum* and *Ombrophytum*, the two other genera of the subfamily Lophophytoideae, the branches of *Lophophytum* are not peltate and their axes are entire

covered by unisexual flowers. The staminate flowers have the perianth reduced to 1–2 fleshy segments, where two stamens with more or less developed filaments are inserted. The female flowers are prismatic and have tubular perianths, with two styles with capitellate stigmas.

Lophophytum weddellii Hook. f. was first described more than 150 years ago (Hooker 1856). However, because of the poor representation of this species in herbaria, it can be considered one of the least known species among the Neotropical Balanophoraceae regarding distribution, morphology, and ecology. For instance, Hansen (1980) listed only three specimens in his review of the family to the Neotropics. Until now, *L. weddellii* was only known to occur in Colombia and Peru at elevations ranging from 500 to 1000 m, frequently associated with Sub-Andean regions, in the upland unflooded forests of the Amazon basin (Hansen 1980; Martínez 1997). This is the only dioecious species of *Lophophytum*, producing unisexual inflorescences which have persistent bracts that cover the entire inflorescence, even during anthesis of the reproductive structures (Hooker 1856). The staminate branches are multiflorous (> 5 flowers) and the thecae are homomorphic (both of the same size) and inserted at the same height on the connective. The female flowers are ebracteolate and have two labiate extensions at the gynoeceum apex. *Lophophytum weddellii* is morphologically related to *L. mirabile* Schott & Endl., a widely distributed species in Brazil (Cardoso 2014a), but they can be easily distinguished by the dioecious inflorescences (vs. monoecious in *L. mirabile*) and by the labiate gynoeceum extensions (vs. lacking in *L. mirabile*) (Hansen 1980).

The first record of *L. weddellii* for the Brazilian flora was determined during the revision of Balanophoraceae in Brazil (Cardoso 2014b). During this work, the specimen J. Ramos & G. Mota 282 (04.03.1976, INPA 56.954), collected in the state of Acre, northern Brazil (07°41'12.89" S, 073°40'44.87" W), was found deposited in the herbarium of the National Institute for Amazonian Research – INPA, Brazil (Figure 1a and 1b).



Figures 1–2. First records of *Lophophytum weddellii* Hook. f. (Balanophoraceae) in Brazil. **1:** Partial view of *J. Ramos & G. Mota 282* (INPA); a. staminate inflorescence; b. pistillate inflorescence. **2:** Image *in vivo* showing two pistillate inflorescences, the left one is longitudinal sectioned and the other one shows bracts partially removed (Photo: M. Silveira, Labev/UFAC).

This specimen has two staminate and one pistillate inflorescence, with all other features that confirm the identity of *L. weddellii*, according to Hansen (1980). Later, we were told that a second record of this species was made in 1996 by researchers from the Federal University of Acre – UFAC, Brazil. There is only one image of this second record, without voucher, because the material rotted and unfortunately was lost before being deposited in the herbarium (M. Silveira, pers. comm.). In this image, which is one of the few *in vivo* images of this species, two pistillate inflorescences can be clearly seen, which distinguishes *L. weddellii* from the other species of the genus (Hansen 1980) (Figure 2).

Both records were made in the Serra do Divisor National Park – SDNP, in the westernmost region of Brazil, in the upper Juruá River basin and near the border with Peru (Figure 3). The SDNP is a difficult area to access that encompasses over 843,000 ha of continuous Amazon Forest. According to Daly and Silveira (2008),

the region of SDNP has many floristic affinities with Andean and Sub-Andean regions. Furthermore, the nearest record of *L. weddellii* to SDNP is just over 320 km west, across the lowlands of the Ucayali River (Peru), in the Sub-Andean mountainous region of Mariscal Cáceres Province (*J. Schunke 5675*; *T. Plowman & J. Schunke 11639*) and Uchiza District at Tochache Province (*T. Plowman 5940*). The distribution pattern of *L. weddellii* is related to the “Restricted to Western Amazonia” pattern, which is one of the most representative patterns for the species already inventoried in the Acre State (Daly and Silveira 2008). Figure 3 shows a compilation of the known records of *L. weddellii* (see additional specimens examined), including those cited by Hansen (1980).

From these two new records for Brazil, the most informative is the one performed by UFAC researchers during the expedition whose voucher was lost. This collection which was made on the margin of the Moa River (07°27'02" S, 073°36'30" W) in the northern portion

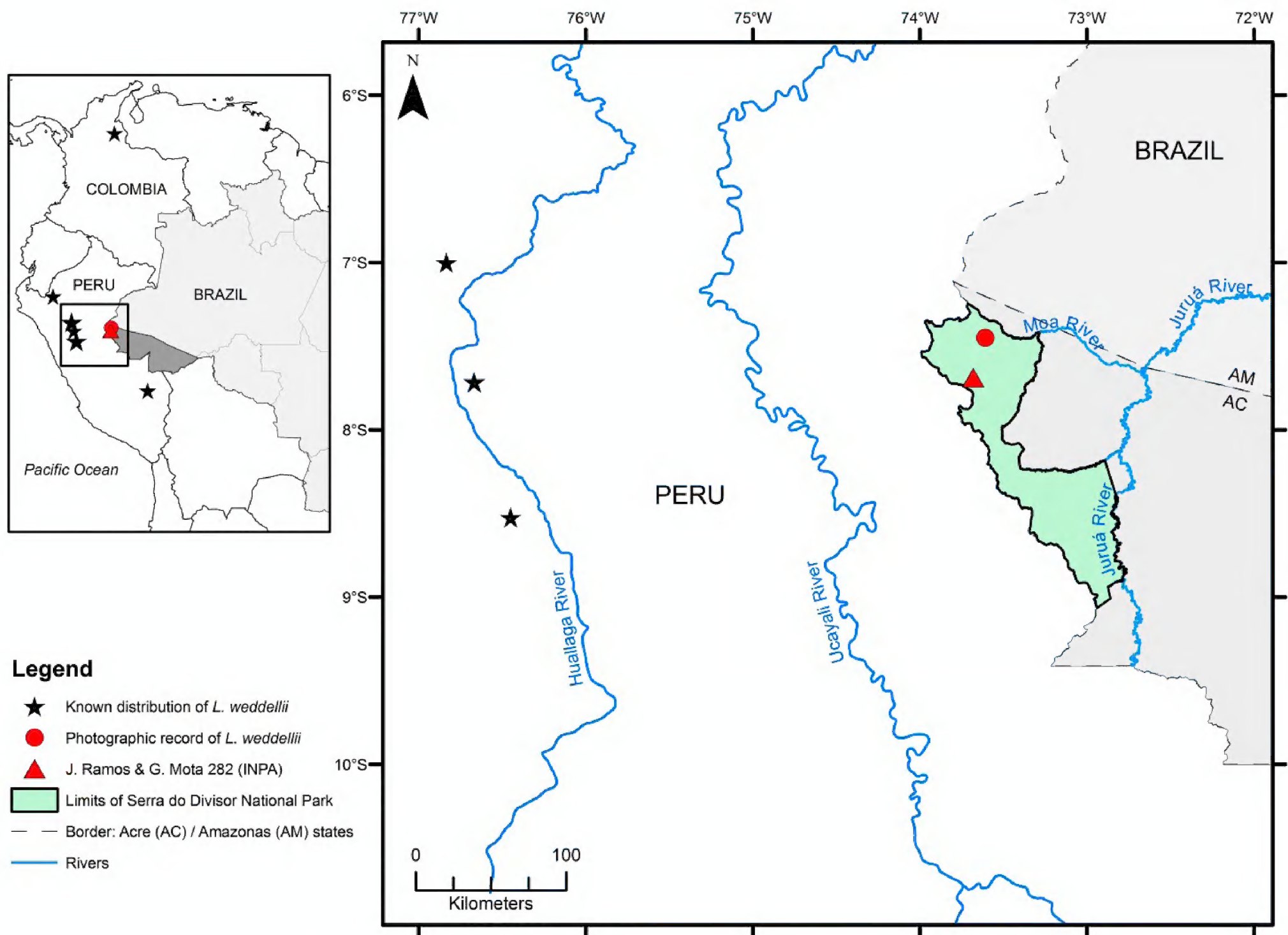


Figure 3. Geographic distribution of *Lophophytum weddellii* Hook. f. (Balanophoraceae) showing the new records for Brazil.

of SDNP adds new habitat information. It indicates that *L. weddellii* inhabits not only the upland unflooded forests (*terra-firme* forests) (Hansen 1980; Martínez 1997) but also open fields near the edge of seasonally flooded lowland forest (*várzea* forests) at ca. 200 m elevation. (M. Silveira pers. comm.). The occurrence of species from subfamily Lophophytoideae in seasonally flooded areas of the Amazon basin is unusual. However, this habitat is common among other Balanophoraceae species, such as *Helosis cayennensis* (Sw.) Spreng. (subfam. Scybalioidae), which inhabits flooded areas (*várzea* forests) and forested wetlands (*Igapó* forests) throughout the entire basin (Cardoso 2014a, 2014b). Unfortunately, none of the records provide information on hosts of *L. weddellii*, which remains unknown for the species. In addition to this new habitat information, the new records contribute to update the First Catalogue of the Flora of Acre (Daly and Silveira 2008), as well as the List of Species of the Brazilian Flora (Cardoso 2014a). Balanophoraceae currently has six genera and 13 species for Brazil, representing approximately 72% of the Neotropical richness, and 30% of all species richness of this family (considering the studies of Delprete 2014; Cardoso and Braga in press; Kuijt and Hansen 2015).

The few records of *L. weddellii* in Brazil act as sampling artifacts in the Extent of Occurrence (EOO) and Area of Occupancy (AOO) calculation, suggesting *a priori* a high level of extinction threat. Nevertheless, it can be stated that the real geographic distribution of *L. weddellii* in the country is still poorly known, and these new records refers to a remote and largely forested region that is contiguous with the actual extensive remaining vegetation of the Acre state (e.g., Shimabukuro et al. 2010). Thus, we cannot accurately recognize the direct threats to the *L. weddellii* populations. Without more information, it was not possible to infer anything about population data and extension of the geographic distribution of *L. weddellii* in Brazil. Thus, based on the International Union for Conservation of Nature criteria (IUCN 2012a), and its recommendations (IUCN 2012b, 2014a), we consider *L. weddellii* as Data Deficient (DD) regionally, and we recommend studies that may support a future regional assessment. Finally, we strongly recommend an international effort to infer the threats and the conservation status of this species in its entire distribution area, since *L. weddellii* is a naturally rare species which has not been recently collected at many of its previous localities (e.g., Colombia), and also had

never been globally assessed (IUCN 2014b).

SPECIMENS EXAMINED: BRAZIL. Acre: Cruzeiro do Sul, Serra do Divisor, sub-base of RADAM/BRASIL Project, sheet SB.18-Z-C-PT.10[100?] [between the Paraná Novo Recreio and igarapé Jesumira, tributaries of Moa River, approximate coordinates 07°41'12.89" S, 073°40'44.87" W], J. Ramos & G. Mota 282 (INPA), 04.03.1976.

ADDITIONAL SPECIMENS EXAMINED: COLOMBIA. *Sine loc.*: F. Sander & Co. s.n. (K, not registred), 28.12.1890. PERU. Amazonas: Bagua, N. Jaramillo & C. Peas 534 (MO), 7.10.1994. Madre de Dios: Manu, P. Núñez et al. 21968 (BRIT, CUZ), 22.05.1998. San Martin: Mariscal Caceres, J. Schunke 5675 (F, S, U), 04.12.1972; Campanilla, T. Plowman & J. Schunke 11639 (K), 21.12.1981. Tocache: Uchiza, T. Plowman 5940 (K) 20.04.1976.

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LITERATURE CITED

- Cardoso, L.J.T. 2014a. Balanophoraceae in lista de espécies da flora do Brasil. Jardim Botânico do Rio de Janeiro. Accessed at <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB56>, 28 November 2014.
- Cardoso, L.J.T. 2014b. Balanophoraceae no Brasil [M.Sc. dissertation]. Rio de Janeiro: Escola Nacional de Botânica Tropical, Jardim Botânico do Rio de Janeiro. 255 pp.
- Cardoso, L.J.T., R.J.V. Alves and J.M.A. Braga. 2011. A new species and a key for *Langsdorffia* (Balanophoraceae). *Systematic Botany* 36(2): 424–427. doi: [10.1600/036364411X569606](https://doi.org/10.1600/036364411X569606)
- Cardoso, L.J.T. and J.M.A. Braga. [In press]. A new Caribbean species of *Helosis* (Balanophoraceae) with a revised key to the genus. *Systematic Botany* 40(2). doi: [10.1600/036364415X688321](https://doi.org/10.1600/036364415X688321)
- Daly, D.C. and M. Silveira. 2008. Primeiro catálogo da flora do Acre, Brasil. Rio Branco: EDUFAC. 555 pp.
- Delprete, P.G. 2004. A new species of *Lophophytum* and the first report of *Lathrophytum* (Balanophoraceae) from the state of Goiás, Central Brazil. *Kew Bulletin* 59(2): 291–295. doi: [10.2307/4115863](https://doi.org/10.2307/4115863)
- Delprete, P.G. 2014. *Ombrophytum guayanensis*, the first record of subfamily Lophophytoideae (Balanophoraceae) in the Guayana Shield. *Phytotaxa* 175(5): 263–269. doi: [10.11646/phytotaxa.175.5.4](https://doi.org/10.11646/phytotaxa.175.5.4)
- Fontana, J. L. and O. F. Popoff. 2006. *Helosis* (Balanophoraceae) en Argentina. *Boletín de la Sociedad Argentina de Botánica* 41(1-2): 85–90. <http://www.scielo.org.ar/pdf/bsab/v41n1-2/v41n1-2a07.pdf>
- Hansen, B. 1980. Balanophoraceae. *Flora Neotropica Monograph* 23: 1–80. <http://www.jstor.org/stable/4393730>
- Heide-Jørgensen, H.S. 2008. Parasitic flowering plants. Leiden: Koninklijke Brill. 438 pp.
- Hooker, J.D. 1856. On the structure and affinities of Balanophoreae. *Transactions of the Linnean Society of London* 22: 1–68. <http://biodiversitylibrary.org/page/6674012>
- IUCN. 2012a. IUCN Red List categories and criteria. Version 3.1. Second edition. Accessrf at http://jr.iucnredlist.org/documents/redlist_cats_crit_en.pdf, 28 November 2014.
- IUCN. 2012b. Guidelines for application of IUCN Red List criteria at regional and national levels. Version 4.0. Accessed at <http://www.iucnredlist.org/technical-documents/categories-and-criteria>, 28 November 2014.
- IUCN. 2014a. Guidelines for using the IUCN Red List categories and criteria. Version 11. Accessed at <http://www.iucnredlist.org/documents/RedListGuidelines.pdf>, 28 November 2014.
- IUCN. 2014b. IUCN Red List of threatened species. Version 2014.3. Accessed at <http://www.iucnredlist.org>, 8 December 2014.
- Kuijt, J. and B. Hansen. 2015. Flowering plants. Eudicots: Santalales, Balanophorales; pp. 193–208, in: K. Kubitzki (ed.). *The families and genera of vascular plants XII*. Berlin, Heidelberg and New York: Springer.
- MacVean, A. and S. Knapp. 2005. *Langsdorffia hypogaea* (Balanophoraceae): un nuevo registro de género y especie para Guatemala. *Brenesia* 63–64: 129–130. <http://biblat.unam.mx/pt/revista/brenesia/10>
- Martínez, R.V. 1997. Flórula de las Reservas Biológicas de Iquitos, Perú. *Monographs in Systematic Botany from the Missouri Botanical Garden* 63: 137–138.
- Shimabukuro, Y.E.; V. Duarte, E. Arai, R.M. Freitas, P.R. Martini and A. Lima. 2010. Monitoring land cover in Acre state, western Brazilian Amazonia, using multitemporal remote sensing data. *International Journal of Image and Data Fusion* 1(4): 325–335. doi: [10.1080/19479832.2010.505177](https://doi.org/10.1080/19479832.2010.505177)

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